Department of Environmental Quality
Remediation Division

Technical Guidance Document #12

Groundwater Monitoring

Introduction

The Department of Environmental Quality (DEQ) evaluates petroleum release sites for groundwater monitoring needs following remedial action using site-specific criteria concerning risks to public health and the environment. Once there is sufficient documentation to verify that contaminant concentrations in groundwater exhibit a decreasing trend or enough data has been obtained to show the contaminant source is controlled and the contaminant plume is stable, then the monitoring frequency may be reduced to semi-annual, annual or even to longer time intervals between events[1]. Annual well inventories[2] must be conducted to assess the condition of the site-related monitoring wells at sites approved for groundwater monitoring at frequency intervals of greater than one year. Monitoring[3] will continue until contaminant concentrations drop below applicable standards. The number of wells required to be monitored during a monitoring event may also be reduced. The DEQ will make these determinations on a site-specific basis. Sites without a monitoring history typically need a minimum of four successive quarters of groundwater quality monitoring to establish seasonal contaminant levels and trends.

Remedial Investigation

During a remedial investigation, the contaminant plume must be fully defined and include source wells within 10 feet or less of each contaminant source where possible. A sufficient number of monitoring wells must be installed to define the extent of the plume. The plume boundary is considered to be identified by wells either at non-detect for contaminants or at contaminant concentrations below applicable Montana Numeric Quality Standards as listed in DEQ -7 and Risk-Based Screening Levels (RBSLs) as indicated in the Montana Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases.

Quarterly Groundwater Monitoring

Quarterly groundwater monitoring is routinely required as a part of the corrective action for the site. Such monitoring must include sampling from one well installed within 10 feet of each source of petroleum contamination where possible. Following the initial monitoring well installation as part of or following the remedial investigation, groundwater monitoring is typically required for at least four or more consecutive quarterly sampling events (one hydrologic year). Quarterly monitoring must continue until at least two sampling events have occurred one year apart during the quarter that marks the highest seasonal contaminant concentration. For sites with contaminated groundwater, this will entail a minimum of five quarterly events and a maximum of eight quarterly events, depending on the season in which sampling commences. For sites where groundwater contamination is below applicable Montana Numeric Water Quality Standards as listed in circular WQB-7 and risk based screening levels

(RBSLs) as indicated in the Montana Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases, sampling may cease after four quarterly events.

Additional Quarterly Monitoring may be required under the following circumstances:

- When four quarters of sampling demonstrate an increasing contaminant concentration trend.
- When the plume is not defined and additional wells will have to be installed to define the threat to potential receptors.
- To evaluate the efficacy of a remediation system. Select monitoring wells as determined by the consultant and the case manager may be omitted from the sampling scheme during remediation system evaluation monitoring.

Semi-annual Groundwater Monitoring

Once the plume has been defined and a minimum of four quarters of groundwater monitoring demonstrates that the plume is not migrating, semi-annual groundwater monitoring can be considered. Semi-annual groundwater monitoring is conducted for the primary purpose of validating seasonal groundwater contaminant concentration fluctuations and groundwater flow direction changes. The owner/operator[4], owner/operator's consultant or the department may propose to omit select monitoring wells from the sampling scheme if contaminant concentrations are below applicable Montana Numeric Water Quality Standards as listed in Circular WQB-7 and risk-based screening levels (RBSLs) for three or more consecutive quarterly sampling events or if the well locations provide redundant information. The wells to be omitted and properly abandoned will be determined by the DEQ case manager and the responsible party[4] and/or the responsible party's consultant on a case-by-case basis. Semi-annual groundwater monitoring is typically performed for two to four consecutive semi-annual events (1 to 2 years) corresponding with seasonally low and high groundwater.

Annual Groundwater Monitoring

If semi-annual monitoring data continue to indicate that the plume is defined and stable, then the site can be considered for annual groundwater monitoring. Select wells, which are to be determined by the responsible party and/or the responsible party's consultant and the DEQ project manager, will be sampled.

If there are seasonal contaminant concentration fluctuations, then the annual groundwater monitoring event must coincide with the hydrologic period (i.e., high or low groundwater) that coincides with the seasonally elevated hydrocarbon concentrations.

Annual groundwater monitoring events will typically be performed for a period of two to three years. If the contaminant concentrations are documented to be stable or decreasing and site conditions do not change (i.e. no additional receptors are constructed) then the site will be considered for long-term monitoring.

Long-Term Groundwater Monitoring Criteria

Based on annual monitoring results, monitoring frequencies at a site may be further reduced to a "long-term monitoring" level as described below. Long-term monitoring is considered to be monitoring necessary at sites where compliance with DEQ 7 standards and RBSLs may take decades. One goal of long-term monitoring is to document the attenuation of petroleum hydrocarbons by biologically mediated processes, commonly referred to as monitored natural attenuation (MNA). The following criteria must be met before a site will be considered for long-term monitoring.

- The plume must be either stable or shrinking as described above, and documented by sufficient analytical data collected from previous groundwater sampling events. An expanding or migrating plume must remain on a stringent sampling schedule to ensure that downgradient receptors are not impacted, and to provide information necessary to make informed decisions.
- All potential receptors must have been previously identified and investigated, where deemed necessary by the DEQ project manager , and determined that they are not at risk from the contaminant plume. Potential receptors include but are not limited to structures (vapor pathway), downgradient domestic wells, surface water, utility corridors, and water lines including mains and service lines. Changes in potential receptors, i.e., new structures, domestic wells, water lines, etc., will be re-evaluated by the DEQ when a site is undergoing or is being considered for reduced monitoring. It is the responsibility of the owner/operator to keep the DEQ informed of new construction in the vicinity of the site's contaminant plume. The DEQ will determine if the new structure is a potential receptor and if additional investigation is warranted.
- Monitoring wells must be properly constructed and maintained. In unconfined hydrogeologic settings, they must be screened across the water table for all anticipated seasonal groundwater levels; the sand pack must be at least two feet above the well screen. The well-heads must be finished in such a manner as to preclude infiltration of surface runoff. Poorly maintained or unsecured wells can act as conduits, allowing contaminants to enter the aquifer, compromising groundwater quality and skewing analytical data. In order to ensure the validity of sampling results when a reduction in monitoring frequency is under consideration, the DEQ will consider the adequacy of well maintenance.
- The owner/operator (o/o) must maintain the monitoring wells in a useable and environmentally safe condition and provide access to the monitoring wells.
- Annual well inventories[2] must be conducted to assess the condition of the site-related monitoring wells at sites approved for groundwater monitoring at frequency intervals of greater than one year.
- If land use or site conditions change or new information is obtained, the DEQ will re-evaluate the monitoring frequency.
- Long-term monitoring frequency, number of wells, and the types of analyses requested, should be tailored to each release based upon site-specific conditions. The DEQ case manager will consider the technical information, land use, and potential for harm to human health and the environment, and all other pertinent factors, to determine what minimum data is necessary to make sound environmental decisions at the site as monitoring continues.

Groundwater contamination plumes that demonstrate decreasing trends over time, may allow routine monitoring to be reduced to a minimum data set necessary to document the continuing trends. Sites with a reduced monitoring frequency may be required to collect a more complete analytical dataset at less frequent intervals or when the release is considered for final closure.

- When information indicates that certain types of contaminants have not been sampled previously, DEQ may require additional one-time groundwater sampling for these constituents or continued groundwater sampling. Additional analytes may also be requested if DEQ suspects that a new release has occurred at the facility. This situation may arise when new information indicates that certain components may be present but not analyzed for previously, such as fuel additives. This may also arise when new environmental industry standards are adopted or toxicology findings indicate that exposure pathways were not adequately investigated at the release. An example of this may include evolving areas of study such as soil vapor intrusion into buildings.

If monitoring is anticipated for more than 15 years, then the following requirements apply.

- Each site must have an estimated time when the groundwater contaminants that are in exceedance of applicable groundwater standards (DEQ-7) and guidelines (Montana Tier 1 Risk Based Corrective Action Risk-Based Screening Levels) will degrade to compliance concentrations. The time estimate may be generated by linear regression of one or more of the contaminants and/or by utilizing natural attenuation data in a groundwater model such as Bioscreen or Bioplume or other suitable means to estimate the compliance date.
- Well inventories must be conducted annually or at a frequency determined at the discretion of the DEQ project manager not to exceed once every three years. Static water level readings must be obtained from the worst-case and other pertinent site-related wells at a maximum interval of once every three years. Groundwater sampling of the worst-case well and any additional wells must be conducted once every five years. Groundwater samples must be submitted to a DEQ approved lab for the appropriate petroleum hydrocarbon analysis and natural attenuation or intrinsic biological indicator (IBI) data. The analytical results must be compared with the predicted concentration to evaluate the accuracy of the compliance timeframe estimate. The compliance target date should be recalculated using the site-specific data.

1 The Board of Water Well Contractors rules ARM 36.21.809 states, "Wells which have not been monitored for more than three years shall be deemed abandoned unless written permission is obtained from the board to maintain the well."

2 Annual well inventory consists of verifying the presence or absence of a well and assessing the condition of the wells to ensure that routine wear and tear have not damaged or destroyed the well's integrity. The findings should be recorded on the Petroleum Release Section Monitoring Well Inventory Form.

3 Monitoring consists of collecting a groundwater sample for analysis and/or measuring the static water level.

4 The owner/operator or responsible party must have personnel trained in qualified environmental personnel.

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